1) Consider the vectors $u = (1,2,-8)$, $v = (-2,3,1)$ and $w = (2,0,8)$.
   a) Determine the cosine of the angle between u and v and decide whether it is acute, obtuse or they are orthogonal.
   b) Find the vector component of u along w and the vector component of u orthogonal to w.
   c) Find a vector orthogonal to both u and v and then find the area of the triangle determined by the vectors u and v.
   d) Find the norm of $u - 2v$ and the distance between u and v.
   e) Find the volume of the parallelepiped in the 3-space determined by the vectors u, v and w.

2) a) Find the equation of the plane passing through the point $P(1,2,-3)$ and parallel to the plane whose equation is $-3x+2y+2z+10=0$.

b) Show that the planes $x-2y+3z-2=0$ and $2x-4y+6z-1=0$ are parallel and find the distance between them.

c) Find parametric equations for the line passing through $P(-3,-1,2)$ and which is parallel to the vector $n=(2,-1,3)$.

d) Find the equation of the plane passing through the points $(1,-1,1)$, $(2,-1,0)$ and $(-1,2,4)$.

3) Consider the linear operators $T: R^2 \to R^2$ and $S: R^2 \to R^2$ where T has the standard matrix representation $[T] = \begin{bmatrix} 2 & 2 \\ 4 & -2 \end{bmatrix}$ and S is the rotational operator counterclockwise by an angle $\frac{\pi}{4}$.

   a) Is the operator T one to one ? Onto? Why?
   b) Find the vector $v = (ToS)(u)$, where $u = (0, \frac{\sqrt{2}}{2})$.
   c) Find $T(-2,2)$ and $S(-1,1)$.
   d) Find $(SoT)^{-1}(w)$ if exists, where $w = (-1, -1)$.

4) a) Determine whether the polynomials

$p_1(x) = 1 + x + 2x^2, \quad p_2(x) = 1 + x^2, \quad p_3(x) = 2 + x + 3x^2,$ span the vector space P_2 of all real polynomials with degree lass than or equal to 2.

b) Find and describe the kernel of the linear operator $T: R^3 \to R^3$ defined by

$$T(x, y, z) = (x - 2y + 3z, -3x + 6y + 9z, -2x + 4y - 6z).$$